Shelter Concepts Inc.
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Brooklyn, N.Y. 11205
Telephone 212 622-7328

SHELTER CONCEPTS

Mr. Seymour B. Durst - President
The Durst Organization, Inc.
1133 Avenue of the Americas
New York, New York 10036

May 8, 1975

Dear Mr. Durst:

I am writing to you concerning our city, its housing crisis and an important alternative which, if properly applied, will generate a substantial amount of new housing construction.

The extensive use of systems building in the last few years has given rise to the expectation that a new multi-family housing system would soon be developed which could reduce the cost of construction by 25% and construction time by more than 50%. A system with this capability would give our cities the potential to attract private investment for new housing, better utilize available subsidies and create hundreds of new jobs.

I am pleased to state that such a housing system has recently been developed by a team of architects and engineers who were formerly associated with the Operation Breakthrough Industrialized Housing Program.

This new system utilizes lightweight concrete modules to form a wide variety of building types from 4 to 42 floors in height. Its application to residential design and impressive cost savings are briefly described in a booklet which I have enclosed with this letter. A more detailed analysis on capital investment, labor, equipment requirements, transportation, site erection and final building costs is available upon request.

Because of its efficient factory production and unique module placement, this approach represents a positive advancement over previous systems and, we believe, the most effective multi-family housing system to emerge from the industry experimentation of recent years.

Edward D. Kelbish, President
George J. Rehl, Vice President
Ralph Pasquale, Vice President
Herbert Kass, Vice President

We are presently in contract negotiations with a French investment group for the application of our system in France and Israel. Their selection of the Shelter Concepts system is based on a thorough study of all European and U.S. housing systems and their conclusion that the factory finished module is the most promising method to reduce the high costs in multi-family housing. I am pleased to note that in their specific study of modular or "volumetric" systems, ours rated number one.

Here in New York there is, unfortunately, trade union resistance to the factory finished concrete module. Today, however, with our critical need for new housing, jobs for construction workers and training programs for the unskilled, it is possible to remove this constraint.

I know that you have considerable influence in the building industry, and I would greatly appreciate any assistance you could provide to help us form an acceptable consortium team for the application of this new housing system.

I sincerely hope the enclosed material will be of interest to you. If you require any additional information, please do not hesitate to contact me.

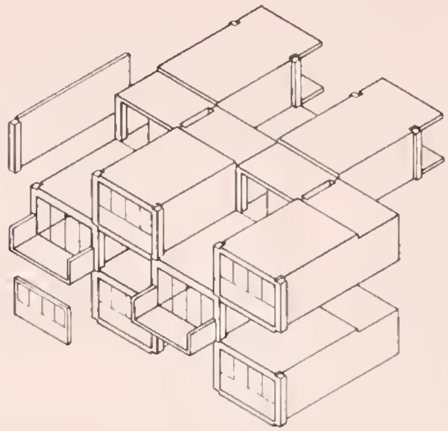
Very truly yours,

Edward D. Kelbish

Edward D. Kelbish R.A.
President
Shelter Concepts Inc.

EDK:dik
Enc.

SHELTER CONCEPTS



MULTI-FAMILY HOUSING SYSTEM : THE NEW CONCRETE MODULE

MULTI – FAMILY HOUSING SYSTEM

CONTENTS

INTRODUCTION

This MULTI-FAMILY HOUSING SYSTEM was researched and developed by a team of architects and engineers who were formerly associated with the Operation Breakthrough industrialized housing program.

A primary goal for our team effort was to discover a building system which could substantially reduce the escalating construction costs of multi-family housing. These rising costs, due to high interest rates and inflation, have severely depressed the shelter industry at a time when new housing is most needed.

Another goal was to evolve a building system with an economic and easily achieved design flexibility. It is our feeling that new communities constructed from industrialized housing systems are most successful when the development team is given a full range of design options.

The MULTI-FAMILY HOUSING SYSTEM presented here meets these important goals with its unique modular assembly and the application of advanced technology in the design and manufacture of lightweight concrete modules.

The system has been awarded United States patents, and additional related patents are pending here and abroad. It is our plan to license production of the modules to qualified companies. Working from a basic catalogue, developers, planners and architects will be able to select the pre-engineered modules according to their budget and program requirements.

It is expected that this system will prove to be the most cost-effective of all known high-rise systems.

Edward D. Kelbish R.A.
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RESEARCH

Last year, manufacturers of pre-engineered metal building systems were responsible for 20% of all single story non-residential buildings constructed in the United States. The mobile home manufacturers were responsible for over 33% of all 1973 single-family housing starts. The cost of these mobile units averaged $8,000 compared to the $34,000 average for the conventional site-built house. These impressive achievements are related to the application of one basic concept - a uniform and completely finished factory product, requiring a minimum of on-site work.

In the medium and high-rise segment of the shelter industry, the movement toward industrialized building has started with the use of flying forms and precast panel systems. Although these methods have reduced construction time, their focus has been on building structure, and therefore they have not achieved substantial reductions in "overall" construction costs. The mechanical and finishing work for their buildings must still be done in the field - an expensive process that limits the economies of assembly line production.

The modular or volumetric system does offer a completely finished factory product, reduced field labor and substantial reductions in overall construction costs. A comparative analysis of existing modular concrete systems indicates that the extent of these advantages is directly related to module placement in the final building. For example, the FULL OVERLAPPED SYSTEM stacks modules directly over each other to form a building structure (plan A, page 5). This approach offers efficient central utility areas where kitchens and bathrooms are grouped to provide plumbing economies. The cost limitation for this system is found in the living areas where the unnecessary duplication of concrete floors and walls occurs. The FULL CHECKERBOARD SYSTEM resolves the problem of floor and wall duplication by stacking concrete modules in a vertical checkerboard arrangement (plan B, page 5). This approach "creates" bonus living areas between the spaced-apart modules and has led to the following cost projections:

> The findings of a 1970 study for U.S. Home Corp., as reported in the May issue of House and Home, indicated that vertical checkerboard stacking of housing modules in the Miami, Florida area could offer cost reductions in the range of 16 to 22%.

In the 1971 M.I.T. publication, Industrialized Building Systems for Housing, Mr. Robert E. Platts stated that recent ventures into checkerboard stacked modules using on-site factories could provide a cost saving of over 20%.

The U.S. Department of Housing and Urban Development, in its 1973 publication, Design and Development of Housing Systems for Operation Breakthrough, presents a 10 to 20% cost reduction over conventional construction for checkerboard stacked units. These conclusions were taken from the New Jersey prototype constructed by the Shelley System.

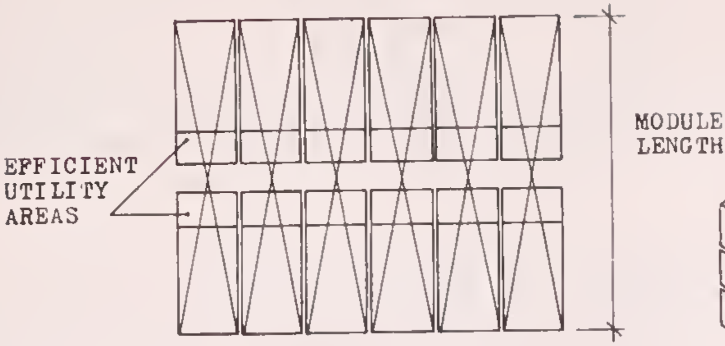
As members of the architectural and engineering team that developed the New Jersey prototype, we felt that even further refinement was possible for this volumetric system. For example, the length of the concrete module for the "typical" center corridor high-rise building, with balconies, was over 64 feet. Although efficient design had reduced the lifting weight of these column supported modules to approximately one ton per linear foot, the modules were still over 62 tons making handling, transportation and site erection costly. This limitation, plus the fact that only one-half of the interior work in the expensive central utility areas could be factory installed, suggested the development of the new modular system presented here.

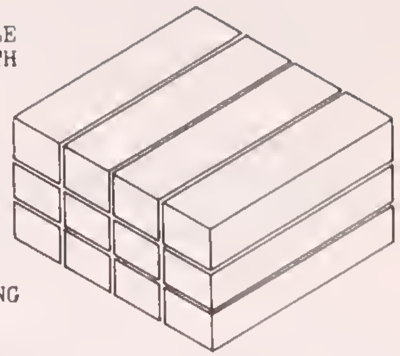
We found that a building system which combined the advantages of both **FULL OVERLAPPED** and **FULL CHECKERBOARD** modular assembly (plan C, page 5) substantially increased the cost reductions of previous modular systems. These cost reductions are the result of:

(a) a workable module length which is always less than the width of the building it forms;
(b) reduced construction time and labor costs from the factory installation of all utilities and substantially all interior work; and
(c) efficient apartment planning along with "created" living spaces.

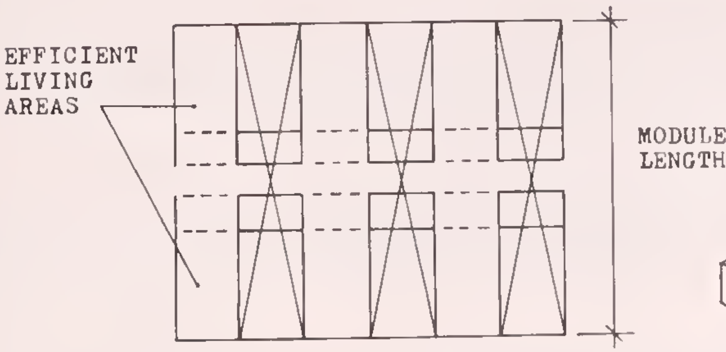
Our research and development for this system was encouraged by the new technological advances in steel molding machines and the use of steam injected concrete which permits the early stripping of mold forms. Using these methods, the casting of two (2) modules per day in the same mold is now possible and factory production rates can be doubled. In addition, we were encouraged by the marketing potential of the concrete module. Our review of the design constraints related to the various housing types indicated that the concrete box was well suited. both functionally and esthetically, to the categories of walk-up, medium and high-rise housing.

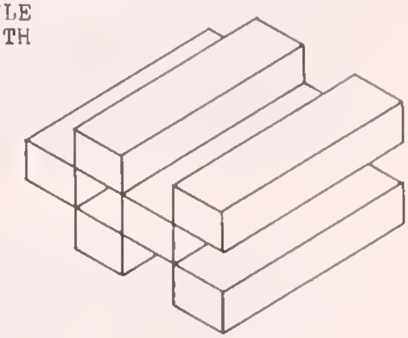
PLAN COMPARISON



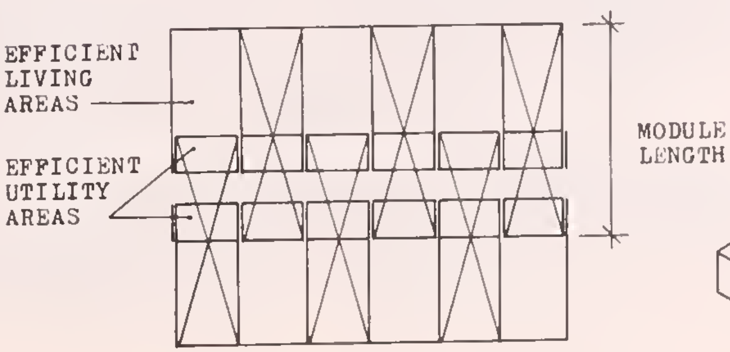


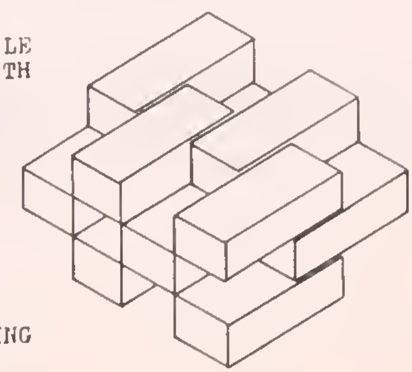
PLAN 'A' - FULL OVERLAP TYPE STACKING





PLAN 'B' - FULL CHECKERBOARD TYPE
STACKING





PLAN 'C' - PART CHECKERBOARD AND
PART OVERLAP TYPE STACKING

SYSTEM DESCRIPTION

The concrete module for this system is factory produced in two stages. First, an inverted "U" consisting of the roof slab, side walls, supporting columns and beams is cast, and then a floor slab is formed or mechanically attached to complete the volumetric structural box. The inverted "U" is cast in a hydraulically-operated steel mold designed to maintain a rigid tolerance control in both the box dimensions and quality of concrete finish. Using a batch mixer which injects steam into the concrete, the handling strength for the stripping of forms can be reached in 5 to 6 hours.

Floor and roof openings required for the stair and elevators and the side wall openings for apartment circulation are easily formed by blockouts and spacers within the mold prior to casting. End walls, stairs, roof panels and side enclosure walls are also factory formed concurrently with the basic modules to meet the erection schedules at the building site.

Prefinishing the modules at the factory starts with casting electric conduits within the walls and floors and continues with the installation of complete kitchens, bathrooms, plumbing trees, partitions, end enclosure walls, balcony handrails, closets and flooring.

Module dimensions are compatible with transport regulations and range from 22 to 38 feet in length and 11 to 14 feet in width. In center corridor type buildings, a complete one-bedroom apartment can be delivered from factory to building site by a single truck (1 module) and a three-bedroom apartment can be delivered by two trucks (2 modules).

At the building site, the modules are placed in a partially overlapped and checkerboard relationship to each other to form a variety of building types from 4 to 42 floors in height. The overlapped modules in the utility areas eliminate the need for applied acoustic control materials. Mechanical connections for kitchens and bathrooms are made through access panels in the mechanical shaft enclosure walls.

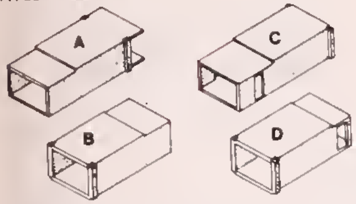
The concrete modules are designed as box-beams (floors 4" and walls 3") offering advantages in field erection and resistance to wind and earthquake forces in the final building. The system eliminates the need for temporary supports or poured field connections.

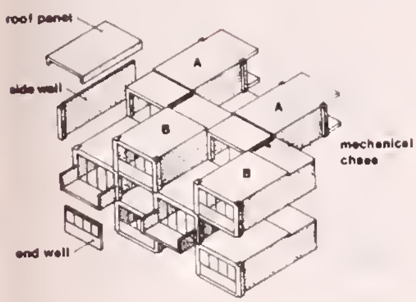
SYSTEM DESIGN RANGE

BASIC MODULES

EXTERIOR CORRIDOR TYPES A & B

CENTER CORRIDOR TYPES C & D

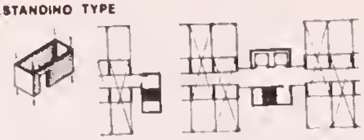




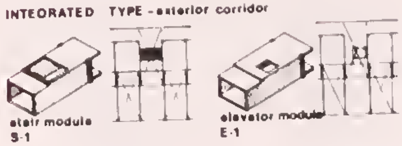
SYSTEM COMPONENTS

STAIR AND ELEVATOR MODULES

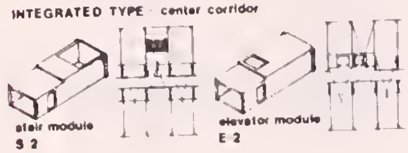
FREESTANDING TYPE



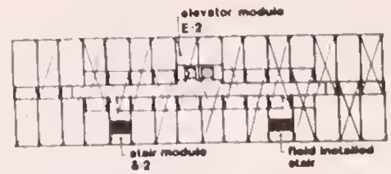
INTEGRATED TYPE - exterior corridor



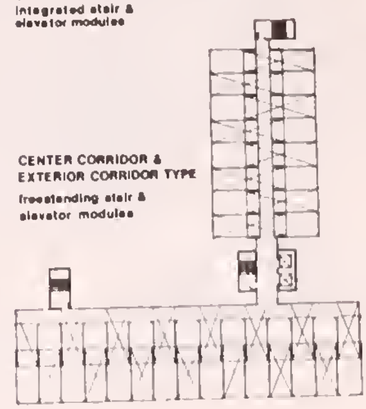
INTEGRATED TYPE - center corridor



MODULE PLACEMENT

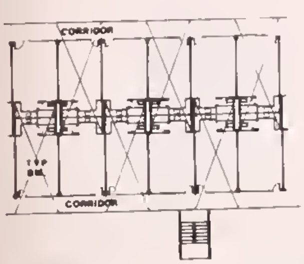


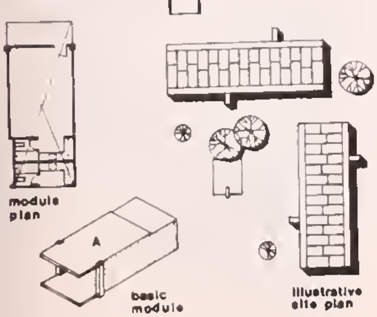
CENTER CORRIDOR TYPE
integrated stair & elevator modules



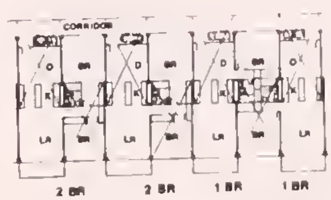
CENTER CORRIDOR & EXTERIOR CORRIDOR TYPE
freestanding stair & elevator modules

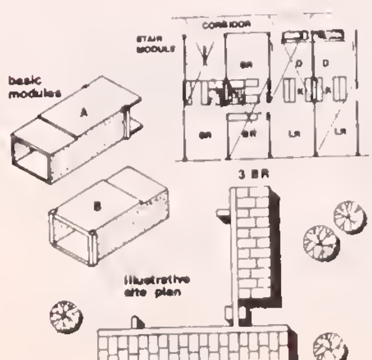
MOTEL-DORMITORY PLANS
exterior corridor type



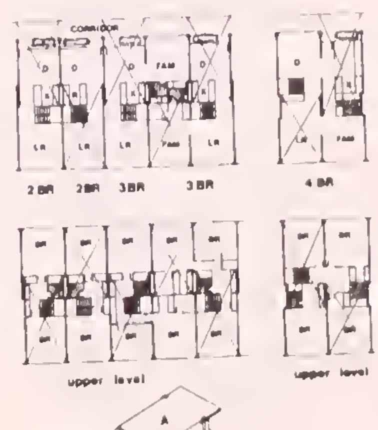


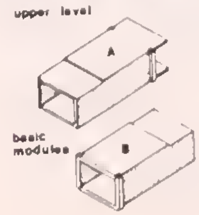
1-2-3 BR APT PLANS
exterior corridor type



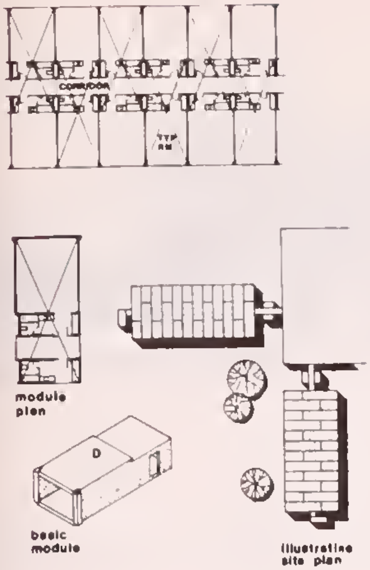


DUPLEX 2 3 4 BR APT PLANS
exterior corridor type

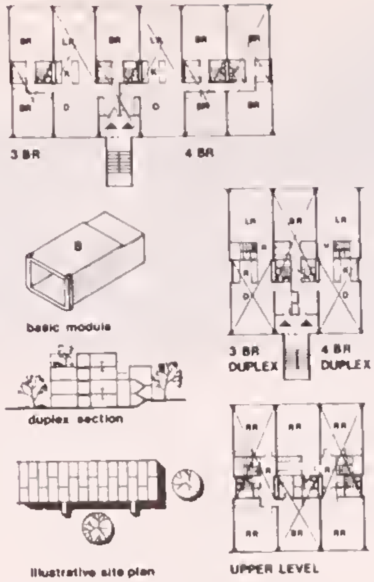




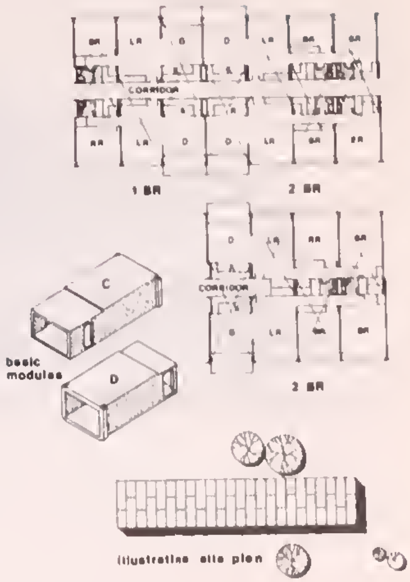
HOTEL-DORMITORY PLANS
center corridor type



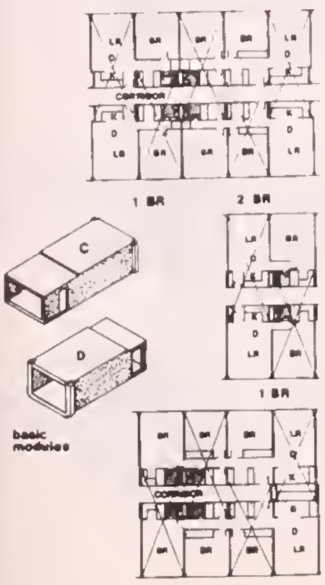
ROWHOUSE PLANS



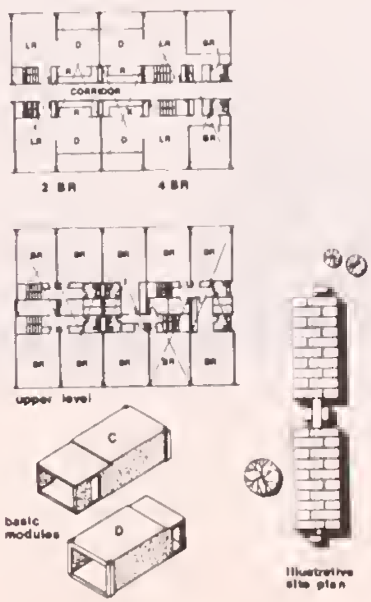
1-2 BR APT PLANS
center corridor type



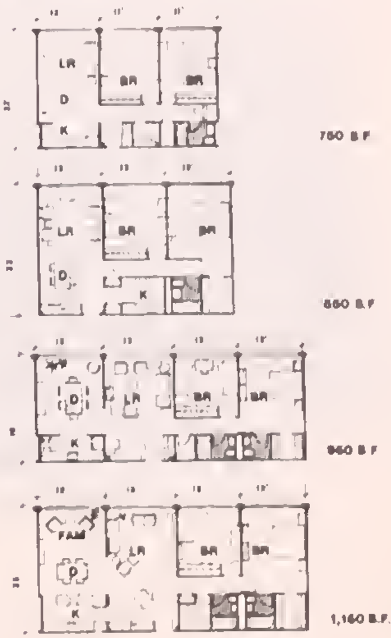
1-2-3 BR APT PLANS
center corridor type



DUPLEX 2-4 BR APT PLANS
center corridor type

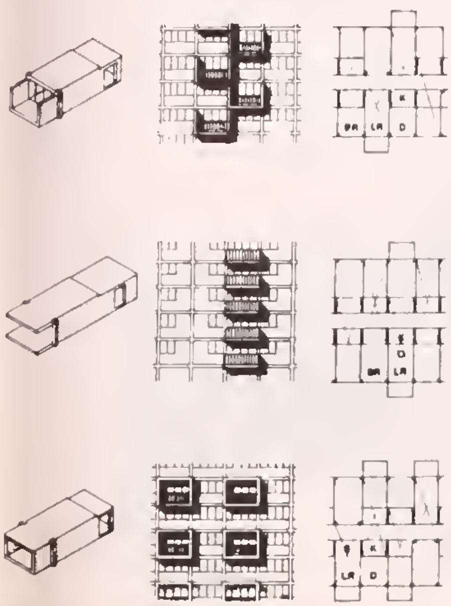


2 BR. APT. PLAN COMPARISON
CENTER CORRIDOR TYPE BUILDING

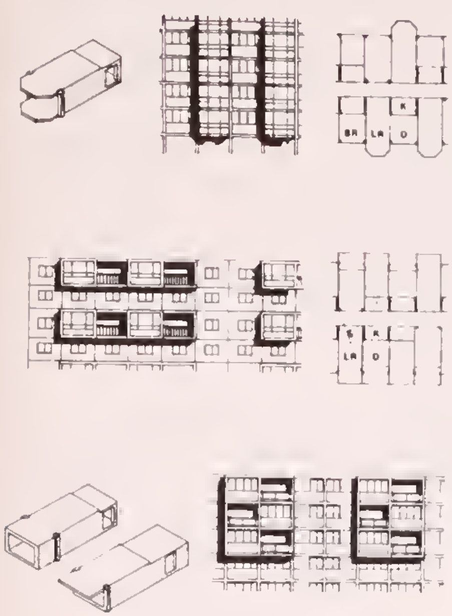


ILLUSTRATIVE BUILDING ELEVATION

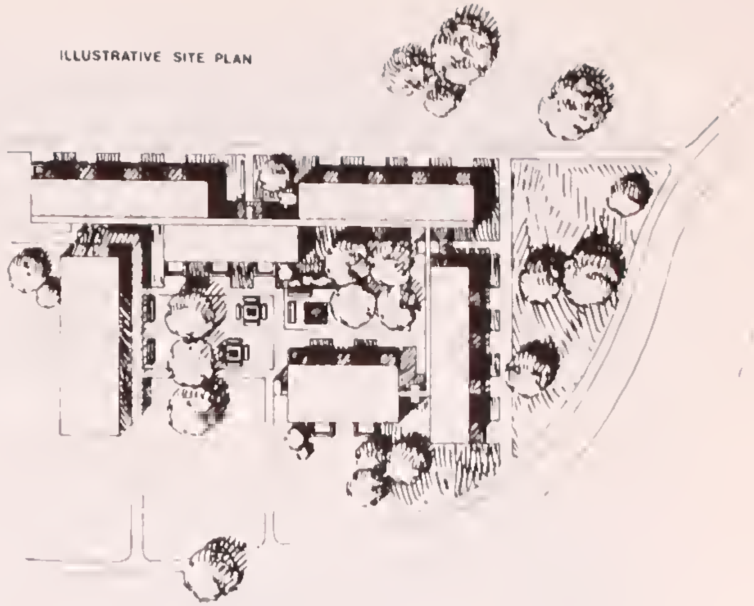
ELEVATION STUDIES · projected balconies

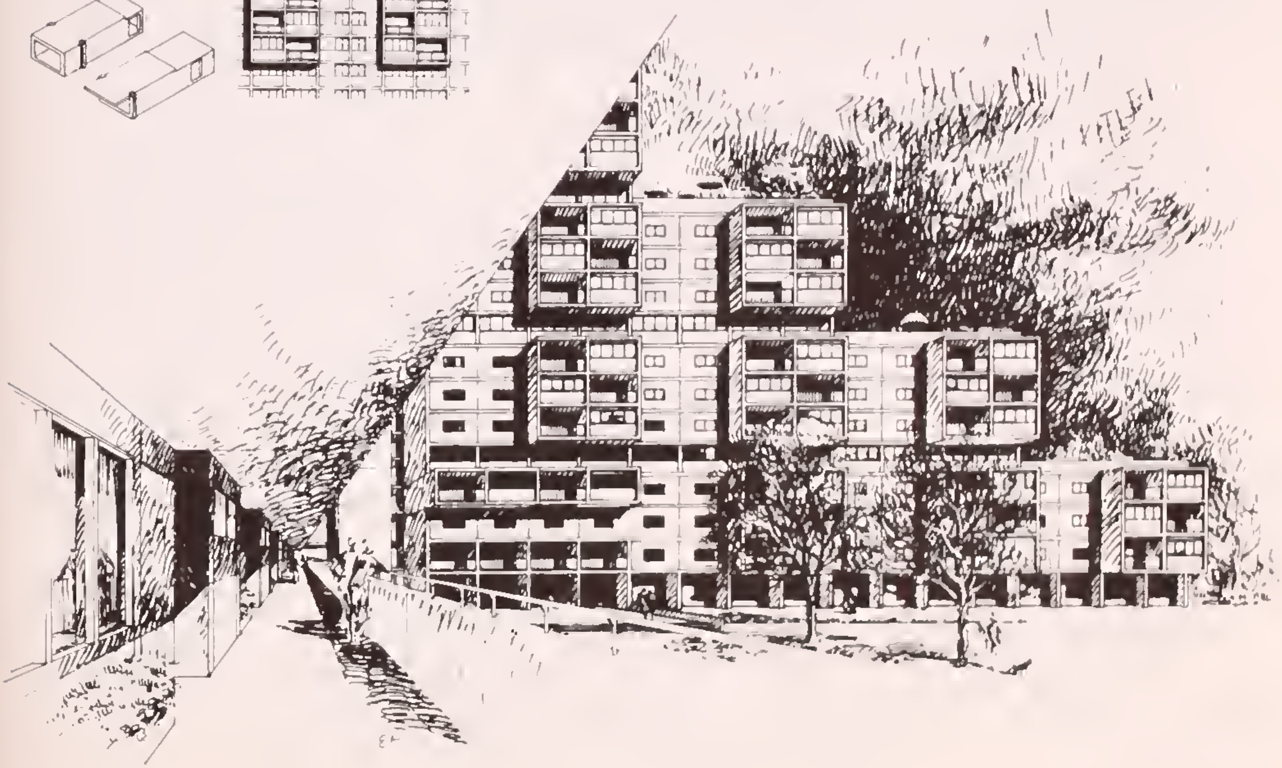


ELEVATION STUDIES projected rooms



ILLUSTRATIVE SITE PLAN





COST SAVINGS

FACTORY PRODUCTION: reduction in the cost of materials with purchases made in volume on a regular basis (original equipment manufacturer); reduction in material handling; reduction in the quantity of concrete from efficient box beam design; reduction in the cost of labor from factory scale wages; uniform production schedules not subject to weather conditions; cost and quality controlled final product.

TRANSPORTATION: reduction in transportation time with a minimum number of building elements shipped to the construction site; reduction in the cost of special trucking and trailer design with economical module lengths.

FIELD WORK: 60% reduction in construction time; reductions in man hours, material handling and labor costs; a typical high-rise apartment floor erected and finished in 2 to 3 working days.

SITE ERECTION: reduction in site crane costs from lightweight modules, shortened erection time and a minimum number of actual lifts; 8 modules/day may be erected at the construction site; capability of building heights over 40 floors minimizing per apartment foundation and roofing costs.

FINANCING: reduction in the cost of construction financing; early revenue bonus.

DESIGN AND MANAGEMENT: reduction in normal design fees and management overhead costs; suggested building prototypes reflect cost trade-offs and optimum systems planning; cost accuracy with modules and components selected from a basic catalogue; reduction in contingency margins.

COST SAVINGS: 20-30% less than comparable conventional construction; 16-24% reduction in mortgage financing.

PATENT PROTECTION

Protection for this system is extensive. To date, there are two (2) United States mechanical patents issued (#3716954, #3835601) protecting the system concept. In addition, there are eight (8) foreign patents pending, copyright protection for the many prototype building plans, and numerous United States design patents pending, protecting the various module profiles.

SYSTEM APPLICATION

This system was previewed at the Chicago Industrialized Building Congress and Exposition. The residential design and marketing appeal of the concrete module in medium and high-rise applications rated high with the architects, planners and developers who attended.

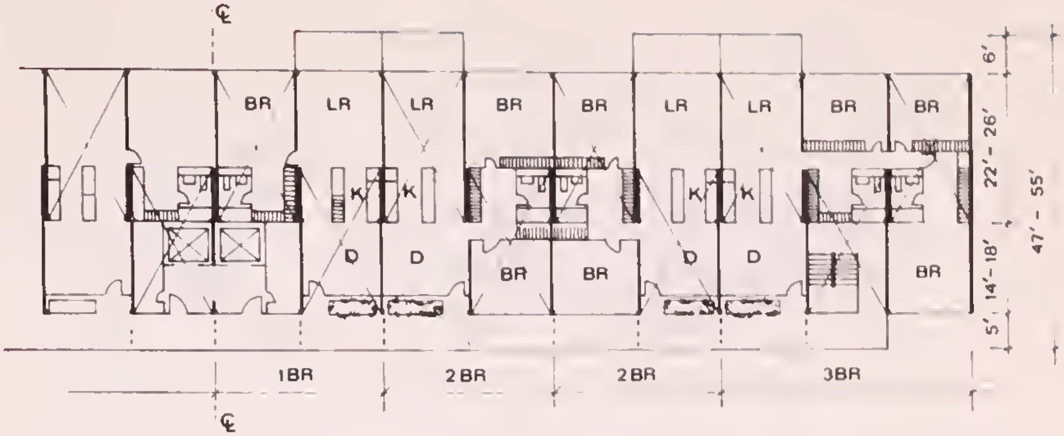
The structural capabilities of the concrete box permit a wide variety of design possibilities which include projected rooms, bay windows, balconies and unique roof treatments. These variations are easily achieved by this system without sacrificing production economies. Although the exterior concrete appearance is generally acceptable, provision has been made in this system for the use of infill brick or metal panels to either contrast with or completely enclose the structural concrete.

A study of multi-family buildings indicated that designers have consistently used certain basic living-dining-kitchen relationships in their apartment planning. The following modular building plans reflect these basic apartment layouts and illustrate a few of the many designs possible for walk-up, medium and high-rise structures. The cross-diagonal lines represent the module areas, while the remaining spaces are "created" by the checkerboard stacking.

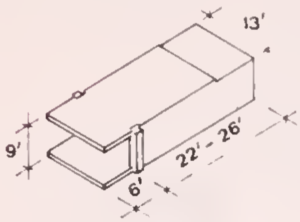
As shown on each plan, the scope of the factory work related to utilities and finishes is averaged for each module. Also, the relationships of module length to apartment area and module quantity to bedroom mix are noted. Modifications to kitchens and bathrooms or bedroom mix are simply achieved by functional substitutions within the modules at the factory.

The stairs and elevators employed in these suggested plans are the integrated or "in-module" type. As previously illustrated, these functional elements may be free-standing in design. These options, along with the wide range in facade treatments, sub-systems and module combinations provide the architect with a complete design choice and the proper interpretation of user needs. To achieve "optimization", all variations will be structured in a form capable of computer manipulation, providing a cost control model and instantaneous feedback to the project development team.

BUILDING PLANS



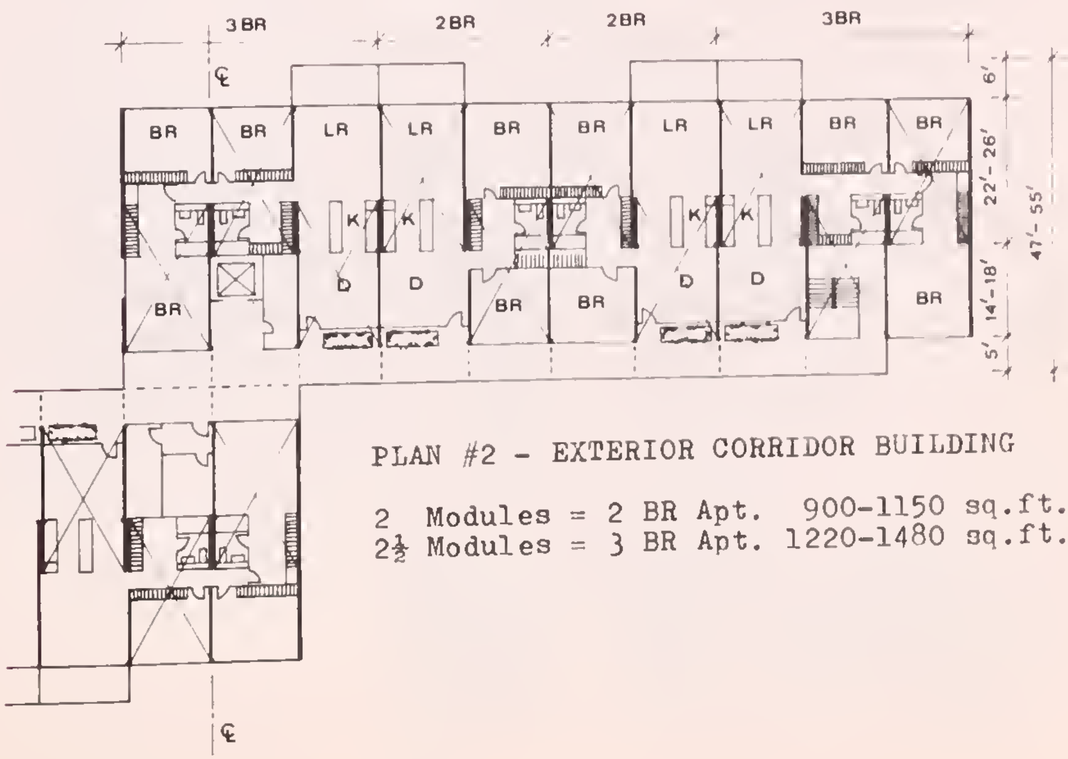
PLAN #1 - EXTERIOR CORRIDOR BUILDING



BASIC MODULE

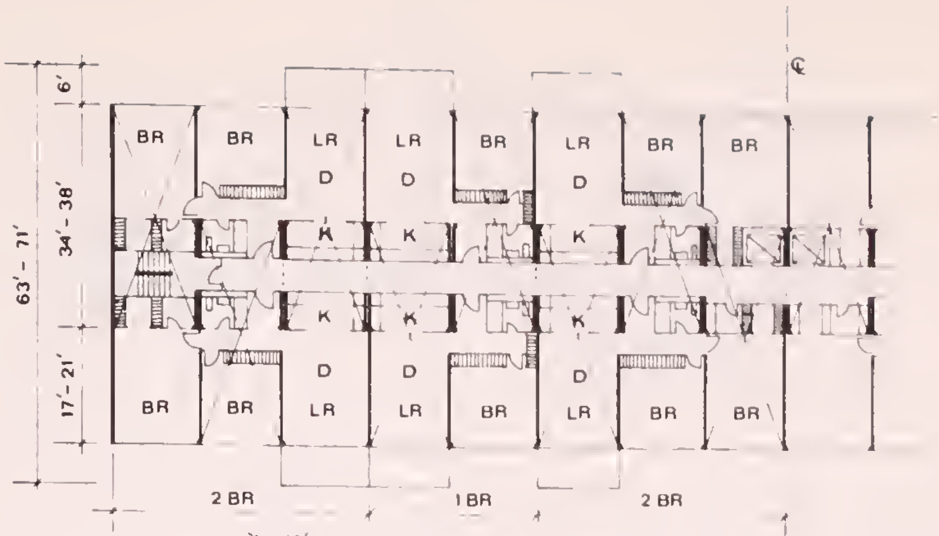
1½ Modules = 1 BR Apt. 750-900 sq.ft.
2 Modules = 2 BR Apt. 900-1150 sq.ft.
2½ Modules = 3 BR Apt. 1220-1480 sq.ft.

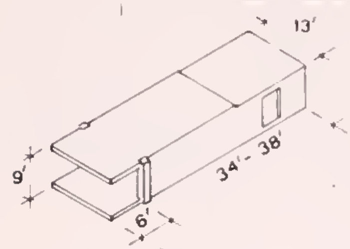
Modules incl: .55 bathrooms; .44 kitchens; .055 exit stairs; 98 sq.ft. exterior wall.
Spaces incl: .055 exit stairs; 98 sq.ft. exterior wall.



PLAN #2 - EXTERIOR CORRIDOR BUILDING

2 Modules = 2 BR Apt. 900-1150 sq.ft.
2½ Modules = 3 BR Apt. 1220-1480 sq.ft.



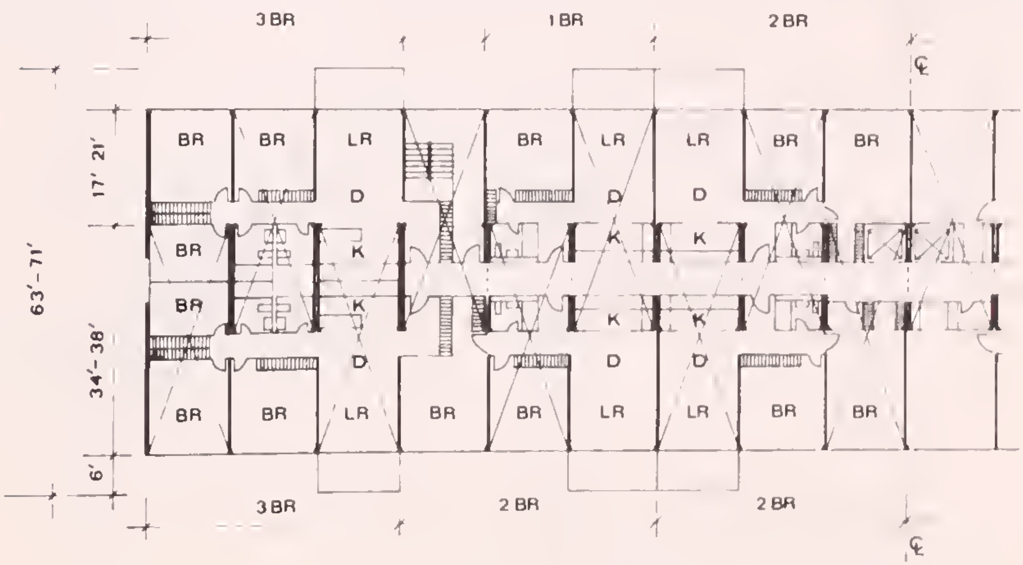


BASIC MODULE

PLAN #3 - CENTER CORRIDOR BUILDING

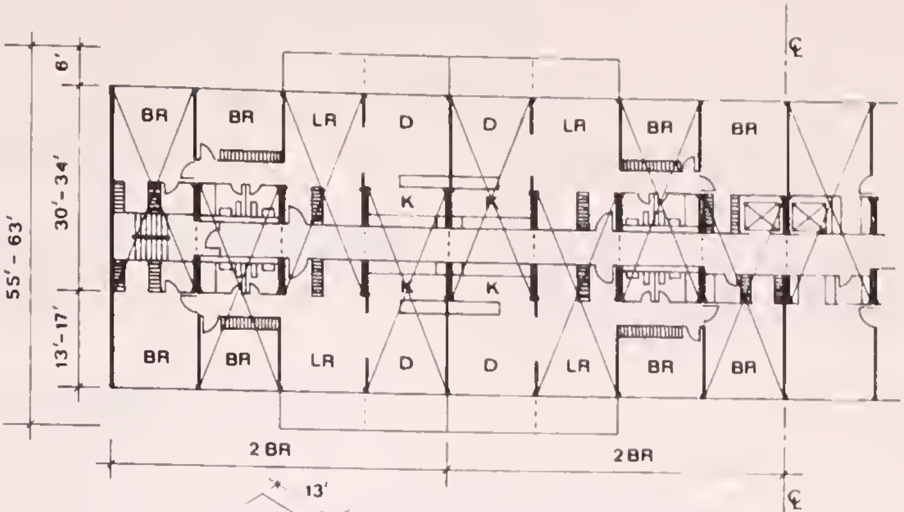
1 Module = 1 BR Apt. 600-700 sq.ft.
1½ Modules= 2 BR Apt. 875-1025 sq.ft.

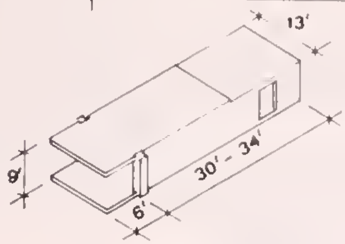
Modules incl: .75 bathrooms; .75 kitchens; .125 exit stairs; 98 sq.ft. exterior wall.
Spaces incl: 98 sq.ft. exterior wall.



PLAN #4 - CENTER CORRIDOR BUILDING

1 Module = 1 BR Apt. 600-700 sq.ft.
1½ Modules = 2 BR Apt. 875-1025 sq.ft.
1½ Modules = 3 BR Apt. 975-1125 sq.ft.



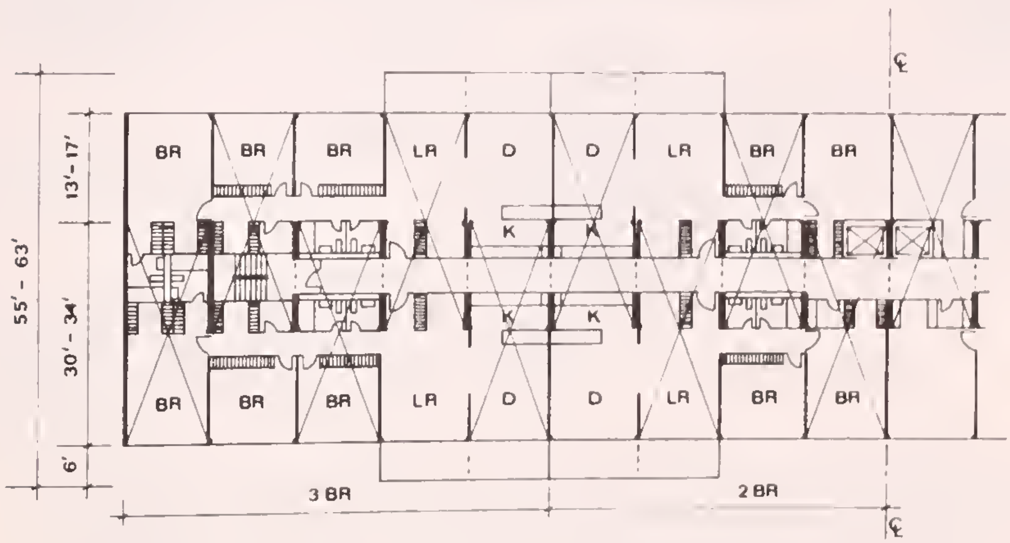


BASIC MODULE

PLAN #5 - CENTER CORRIDOR BUILDING

1½ Modules = 1 BR Apt. 750-900 sq.ft.
2 Modules = 2 BR Apt. 1000-1200 sq.ft.

Modules incl: .75 bathrooms; .5 kitchens; .125 exit stairs; 98 sq.ft. exterior wall.
Spaces incl: 98 sq.ft. exterior wall.



PLAN #6 - CENTER CORRIDOR BUILDING

2 Modules = 2 BR Apt. 1000-1200 sq.ft.
2½ Modules = 3 BR Apt. 1250-1500 sq.ft.

BUILDING COST ESTIMATES

PLAN #1 - EXTERIOR CORRIDOR BUILDING

BUILDING STATISTICS:

Length 234'; width 36'+corridor:
Height 18 floors; 2 elevators;
2 exit stairs; 8 apts./floor;
144 apartments

PRECAST CONCRETE:

324 modules (22')
18 first floor panels (13'x14')
18 roof panels (13'x14')
36 end building panels (8'x14')

Factory production - modules	$1,529,280
Factory production - panels	53,525
Transportation	37,440
Erection	119,372
SUB-TOTAL (direct cost-materials and labor):	$1,739,617
Factory interest and amortization: $500/apt.	72,000
Licensing cost 3%	52,188
Start-up costs 5%	86,980
Factory and home office overhead 18%	313,128
Factory profit 10% (suggested)	173,961
TOTAL FACTORY AND ERECTION COSTS:	$2,437,874
Site work, foundations, mechanical	$ 294,030
Finishing in created spaces, elevators, roofing, etc.	569,307
SUB-TOTAL (direct cost-materials and labor):	$ 863,337
Site overhead 12%	103,596
Contractors profit 10% (suggested)	86,333
TOTAL FIELD COSTS:	$1,053,266
TOTAL FACTORY AND FIELD COSTS:	$3,491,140
Contingency allowance 5%	174,557
TOTAL BUILDING COSTS:	$3,665,697
COST PER SQ.FT.:	$22.31
AVERAGE APT. COST:	$ 25,456

Total direct costs for the above building w/22' modules:
$2,602,954; cost per sq.ft.: $15.84
Total direct costs for a similar building using 26' modules:
$2,813,554; cost per sq.ft.: $14.21

NOTES:
1. Factory production assumes LIUNA factory scale labor.
2. Factory amortization assumes 6 buildings w/864 apartments.
3. Site crane costs from American Hoist and Derrick Co.
4. Estimate - July, 1974 price quotations in N.Y.,N.J. area.
5. Detailed cost breakdown available upon request.

PLAN #3 - CENTER CORRIDOR BUILDING

BUILDING STATISTICS:	PRECAST CONCRETE:
Length 208'; width 51'; Height 18 floors; 2 elevators; 2 exit stairs; 12 apts./floor; 216 apartments	288 modules (34') 16 first floor panels (13'x17') 16 roof panels (13'x17') 36 end building panels (8'x17')

Factory production - modules	$1,901,367
Factory production - panels	57,500
Transportation	37,500
Erection	101,000
SUB-TOTAL (direct cost-materials and labor):	$2,097,367
Factory interest and amortization: $500/apt.	108,000
Licensing cost 3%	62,919
Start-up costs 5%	104,865
Factory and home office overhead 18%	377,514
Factory profit 10% (suggested)	209,730
TOTAL FACTORY AND ERECTION COSTS:	$2,960,395
Site work, foundations, mechanical	361,800
Finishing in created spaces, elevators, roofing, etc.	561,436
SUB-TOTAL (direct cost-materials and labor):	$ 923,236
Site overhead 12%	110,784
Contractors profit 10% (suggested)	92,320
TOTAL FIELD COSTS:	$1,126,340
TOTAL FACTORY AND FIELD COSTS:	$4,086,736
Contingency allowance 5%	204,336
TOTAL BUILDING COSTS:	$4,291,072
COST PER SQ.FT.:	$22.47
AVERAGE APT. COST:	$ 19,866

Total direct costs for the above building w/34' modules:
$3,020,603; cost per sq.ft.: $15.82
Total direct costs for a similar building using 38' modules:
$3,212,295; cost per sq.ft.: $14.54

NOTES:
1. Factory production assumes LIUNA factory scale labor.
2. Factory amortization assumes 4 buildings w/864 apartments.
3. Site crane costs from American Hoist and Derrick Co.
4. Estimate - July, 1974 price quotations in N.Y.,N.J. area.
5. Detailed cost breakdown available upon request.

FACTORY ANALYSIS

The ability to maintain an ongoing and uniform production rate is a primary objective in the development of modular facilities. Under such conditions, the capital investment for building structure and equipment can be quickly amortized. Factories involved with the production of concrete modules for high-rise housing have a definite advantage in this regard, since financing is always arranged on large blocks of apartment units. This allows a company to "lock-in" an optimum production rate and establish a fixed level for amortization.

The following factory cost estimates are based on production facilities which employ two (2) and three (3) molding machines. The production rate for each factory reflects the use of steam injected concrete and two working shifts per day.

Pre-engineered metal buildings are suggested for all facilities. This type of factory construction affords not only a low initial cost, but it allows the option to economically relocate facilities according to regional market demands.

UNIONS:
Production work in the factory (as in the majority of modular facilities throughout the country) will be handled by the Laborers International Union of North America. The United States Government has established the title and classification "Housing Assembly Mechanic" for the semi-skilled workers who perform the construction and finishing work in these modular facilities.

Before any factory commitments are made, a clear agreement will have to be established with the local unions that perform the work at the building site. The present inflation and escalating building costs have led to considerable unemployment in the construction industry. Additionally, there is a growing pattern of selective building in the areas of the nation where labor rates are favorable to developers. These conditions have established a climate for productive negotiations with unions and the expectation of an industrialized building breakthrough in high-rise housing.

This breakthrough is timely, as there is an urgent need for the application of new technology which can answer the demands of those served by the shelter industry: the contractors - who must have work, the builder/developers - who must cut costs, and the public - who must have new housing.

FACTORY COST ESTIMATES

FACTORY #1 - 2 molding machines (22' side wall)
production rate: four 22' modules/day

A. FACTORY CONSTRUCTION:

1. Concrete production; 13,300 sq.ft. @ $8.00	$106,400
2. Finishing area; 18,900 sq.ft. @ $8.00	151,200
3. Storage & workshops; 18,000 sq.ft. @ $7.00	126,000
4. Foundations for molds and equipment; 230 cubic yds. @ $100.00	23,000
5. Offices; 1200 sq.ft. @ $18.00	21,600
6. Installation of plant utilities	53,000
7. Open storage area, roads & parking (base stabilization only, no road surfacing)	68,000
8. Utility connections, land improvements, fences, gates	80,000
TOTAL CONSTRUCTION:	$629,200

B. EQUIPMENT:

1. Travelift (Drott)	$ 90,000
2. Molding machines; 2 @ $72,000 (Stelmo)	144,000
3. Batching plant	60,000
4. Steam mixers; 2 @ $35,000	70,000
5. Conveyors	40,000
6. Boiler & steam distribution	19,000
7. Compressor & air distribution	15,500
8. Vibrators	15,000
9. Steel yard equipment	12,500

10.	Miscellaneous molds (precast concrete)	$ 34,000
11.	Miscellaneous workshop equipment & tools	45,000
12.	Yard operations; payloader, forklift, pick up, etc.	50,000
	TOTAL EQUIPMENT ESTIMATE:	$595,000

C. GENERAL:

1.	Installation of equipment	$ 45,000
2.	Engineering and plans	60,000
3.	Interest construction financing	40,000
4.	General conditions	115,000
	TOTAL GENERAL:	$260,000
	GRAND TOTAL:	$1,484,200

FACTORY #2	2 molding machines (34' side wall) production rate: four 34' modules/day	$1,926,000
FACTORY #3	3 molding machines (22' side wall) production rate: six 22' modules/day	$2,077,880
FACTORY #4	3 molding machines (34' side wall) production rate: six 34' modules/day	$2,696,400

NOTES:

1. The two (2) mold facilities are designed to take maximum advantage of a travelift vehicle for the lifting and placement of modules.
2. The three (3) mold facilities employ an overhead bridge crane in the steel preparation and concrete production areas with the travelift vehicle used in the finishing, yard and loading areas.
3. Equipment estimates assume outright purchase; lease-purchase agreements were not considered for this general estimate.
4. Estimates based on July, 1974 price quotations.
5. Detailed cost breakdown available upon request.

TEAM PROFILE

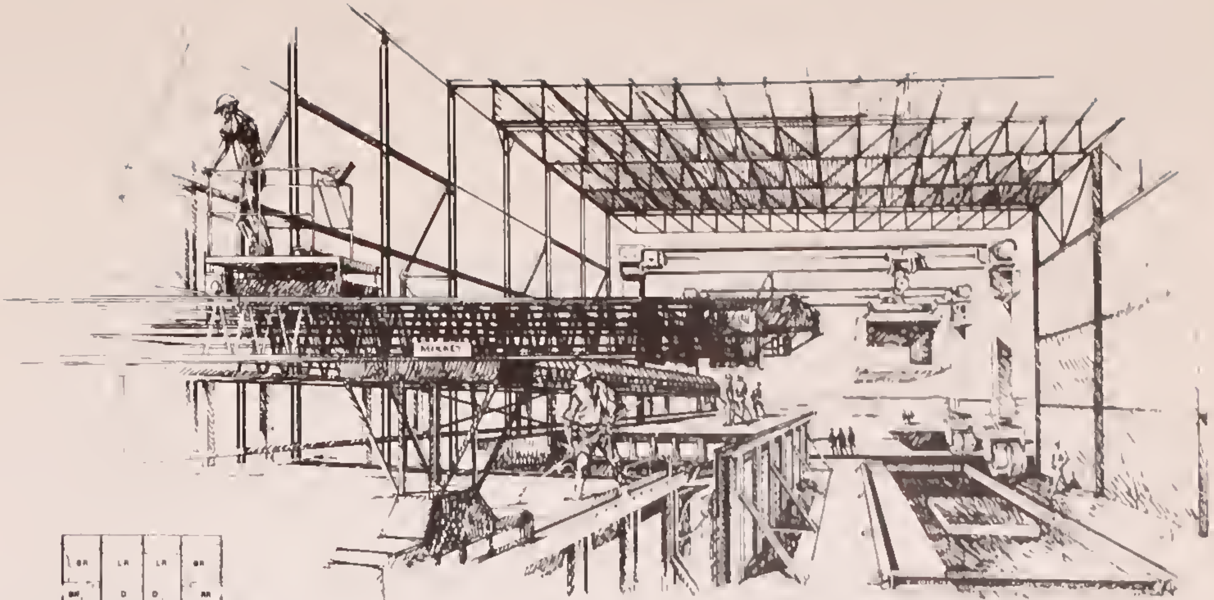
EDWARD KELBISH is the President and coordinator for the Shelter Concepts team effort. A leading designer and systems consultant to the shelter industry, he has developed the architectural prototype analysis for many corporations involved in modular housing. For the last five years, he has conducted a research study into new building technology and the system constraints related to factory production, transportation and field erection of housing modules. The result of this study was the invention and development of many new industrialized building systems for the shelter industry.

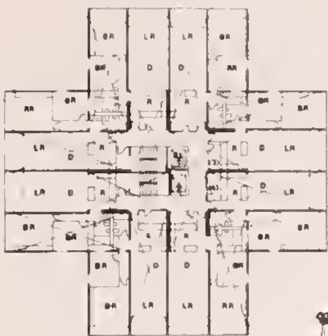
RALPH PASQUALE is Vice President of Operations for Shelter Concepts Inc. He was formerly Vice President of Operations with the Shelley System in New York where he was involved in the systems planning related to the production of concrete modules. He also had the management responsibility for the factory production, quality control, transportation and site erection of the precast modules used in the New Jersey apartment prototype constructed for the Operation Breakthrough program.

HERBERT KASS is Vice President of Systems for Shelter Concepts Inc. He was formerly Chief Architect with the Shelley System for the Operation Breakthrough program where he supervised the research and development of mechanical sub-systems for concrete modules. In addition, he was responsible for the preparation of contract documents, factory production drawings and the coordination of all government agencies and consultants involved in the New Jersey prototype.

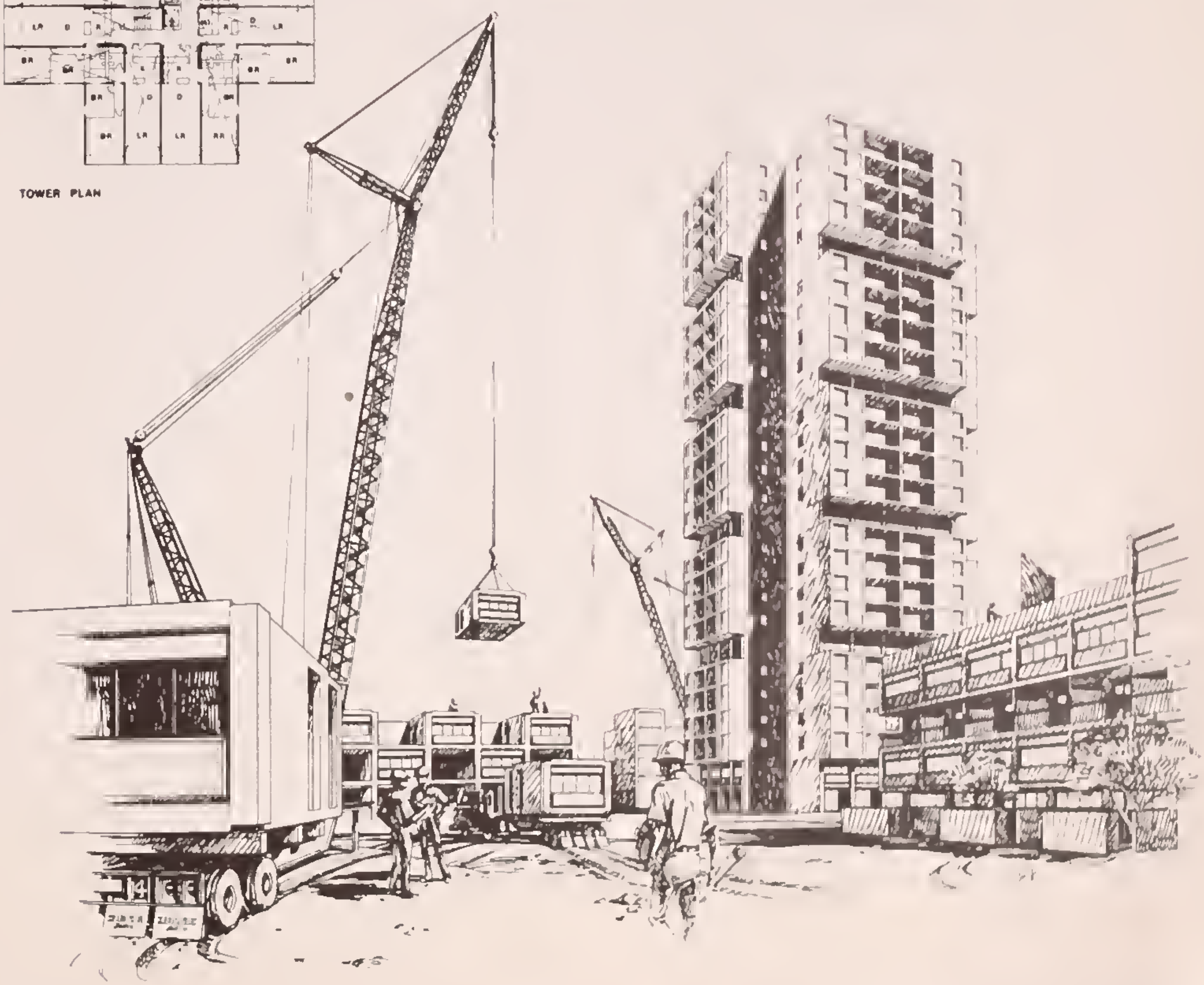
GEORGE REHL is Vice President of Design for Shelter Concepts Inc. He has extensive experience as project architect with design firms who have received many awards in architecture, planning and urban design. He is currently involved in the Shelter Concepts architectural prototype development, code analysis and the research effort to relate the process of industrialization to building design.

ANDREW GYIMESI (Structural Consultant) was formerly Chief Engineer and Techical Manager for the Shelley System in Puerto Rico and New York. His wide experience in precast concrete includes the development of new industrial building systems, special techniques for thin shell construction and new methods in silo construction. Prior to joining the Shelley team, he was Chief Engineer for one of North America's largest precasting firms, and he had a key role in the "Habitat" prototype constructed at Expo '67 in Canada. His innovative structural design for lightweight concrete modules resulted in substantial cost savings for the Operation Breakthrough building constructed in New Jersey.

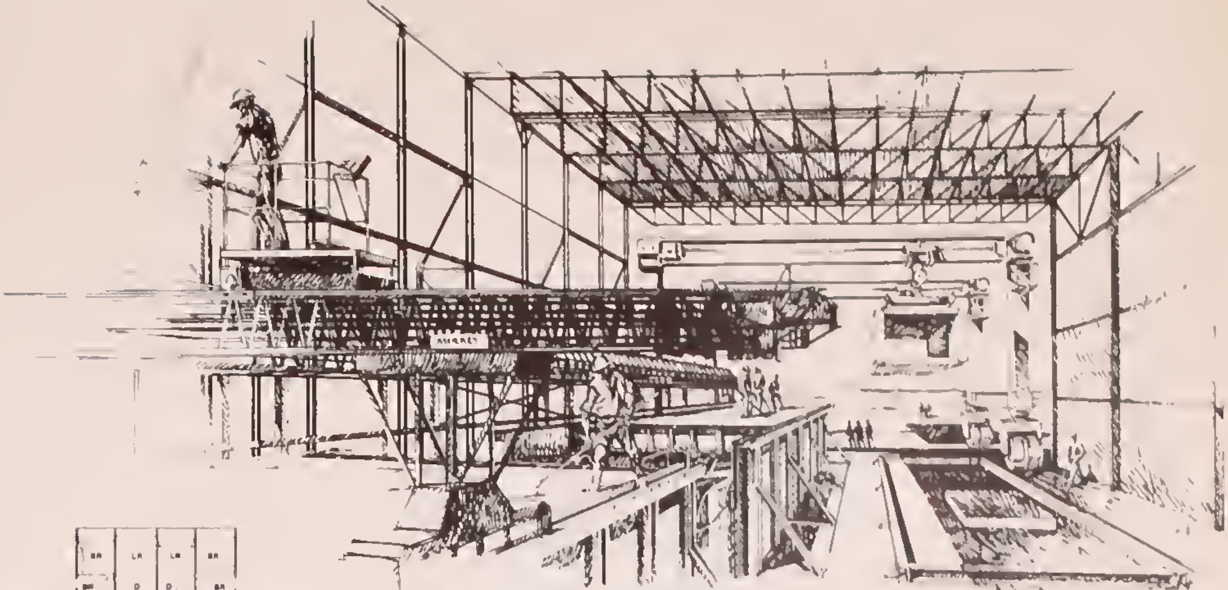


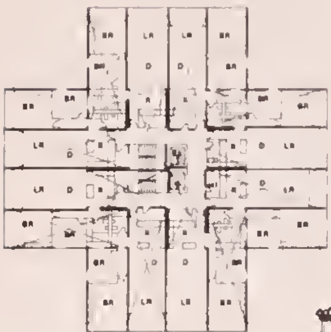


TOWER PLAN



MULTI-FAMILY HOUSING SYSTEM: THE NEW CONCRETE MODULE





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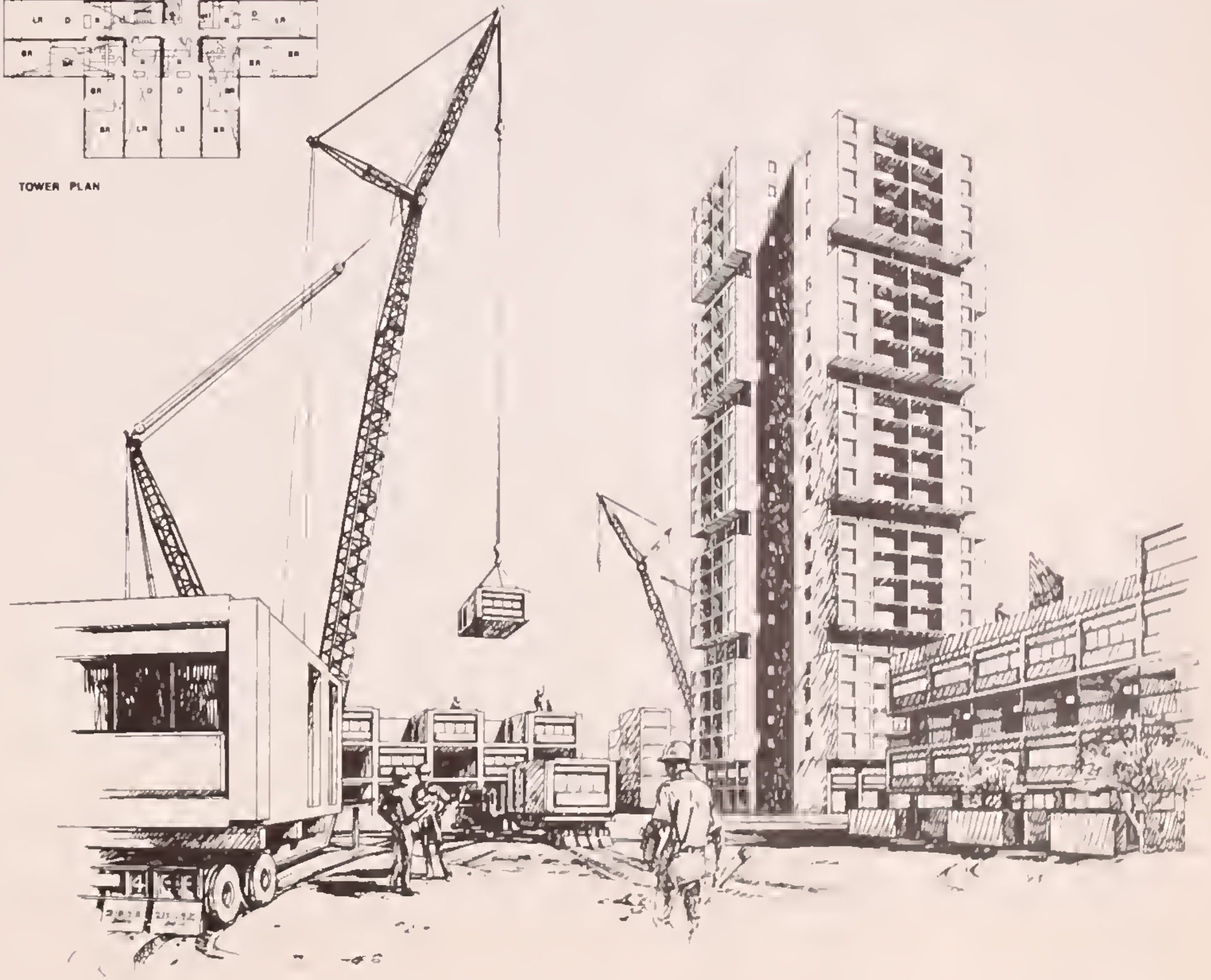

MULTI-FAMILY HOUSING SYSTEM THE NEW CONCRETE MODULE